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ASPARAGUS RACEMOSUS (SHATAVARI): A MULTIPURPOSE PLANT

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ABSTRACT

Asparagus racemosus is an ayurvedic plant with medical importance of tropical and subtropical India. It is important for its sapogenin content the precursor of many pharmacologically active steroids. *Asparagus racemosus* is mainly known for its phytoestrogenic properties with an increasing awareness about the harmful effects with synthetic oestrogens, the interest in plant derived oestrogens has increased tremendously making *Asparagus racemosus* particularly important. *Asparagus racemosus* has been shown to have many other properties like anti-abortifacient activity, Antidepressant, Anti-diarrhoeal, Antiulcerogenic action, antibacterial, analgesic, Antioxidant etc.

KEYWORDS: *Asparagus racemosus*, Phytoestrogen.

INTRODUCTION

Asparagus racemosus (family- Asparagaceae) also known by the name "Shatavari" is one of the well known drugs in Ayurveda, effective in treating madhur rasam, madhur vipakam, seet-veeryam, som rogam, chronic fever and internal heat.[1, 2] Shatavari means "she who possesses a hundred husbands" indicates that this herb is highly effective in problems related with female reproductive system. Charak Samhita written by Charak and Ashtang Hridyam written by Vagbhata, the two main texts on Ayurvedic medicines, lists *Asparagus racemosus* as part of the formulas to treat disorders affecting women's health.[3, 4, 5, 6]

In modern Ayurvedic practices the roots of plant are considered to be effective as antispasmodic, appetizer, stomach tonic, aphrodisiac, galactogogue, astringent, antidiarhoeal,

antidysentiric, laxative, anticancer, anti-inflammatory, blood purifier, antitubercular, antiepileptic and also in night blindness, kidney problems and in throat complaints.[7] Further, it is mentioned as **medhya**- the plants which increase intelligence and promote learning and memory,[8] and as **rasayana,** the rejuvenator herbs which improves health by increasing immunity, vitality and resistance, imparting longevity as well as protection against stress.[9] This herb is also mentioned as **balya** means a strength promoter, **stanya**-a galactogogue[1] and **jeevaniya**- an erythropoetic.

PLANT PROFILE

Scientific classification

Kingdom : Plantae

Division : Angiosperms

Class : Monocots

Order : Asparagales

Family : Asparagaceae; Liliaceae

Genus : Asparagus

Species A*sparagus :* Racemosus

Asparagus racemosus Wild. (family Asparagaceae; Liliaceae), is commonly called Shatavari, Satawar or Satmuli in Hindi; Shatavari in Sanskrit; Shatamuli in Bengali; Shatavari or Shatmuli in Marathi; Satawari in Gujarati; Toala-gaddalu or Pilli-gaddalu in Telegu; Shimaishadavari or Inli-chedi in Tamil; Chatavali in Malayalam; Majjigegadde or Aheruballi in Kannada; Kairuwa in Kumaon; Narbodh or atmooli in Madhya Pradesh; and Norkanto or Satawar in Rajasthan.

The plant grows throughout the tropical and subtropical parts of India up to an altitude of 1500m. The plant is a spinous under-shrub, with tuberous, short rootstock bearing numerous succulent tuberous roots (30–100 cm long and 1–2 cm thick) that are silvery white or ash colored externally and white internally.[10]

These roots are the part that finds use in various medicinal preparations.[11, 12, 13] The stem is woody, climbing, whitish grey or brown colored with small spines. The plant flowers during February–March leaving a mild fragrance in its surrounding and by the end of April, fruits can be seen with attractive red berries.

Asparagus racemosus is a plant used in traditional Indian medicine (Ayurveda).[14]

Pharmacological activities

Anticancer activity, antidysenteric activity, antifungal activity, antibacterial activity, anti-inflammatory activities, antiulcer activity, antioxidant activity, anti-abortifacient activity, Antioxytoxic, spasmodic to uterus Hypoglycemic, hypertensive activity, anticoagulant activity.[15]

It is taken internally in the treatment of infertility, loss of libido, threatened miscarriage, menopausal problems, hyperacidity, stomach ulcer and bronchial infection. Externally it is used to treat stiffness in the joints.[16] The root is used fresh in the treatment of dysentery. It is harvested in the autumn and dried for use in treating other complaints. The whole plant is used in the treatment of diarrhea, rheumatism, diabetes and brain complaints. It is also used in management of behavioral disorder and minimal brain dysfunction.[17] The rhizome is a soothing tonic that acts mainly on the circulatory, digestive, respiratory and female reproductive organs. The root is alterative, antispasmodic, aphrodisiac, demulcent, diuretic, galactogogue and refrigerants.[18]

MEDICINAL USES[19]

Asparagus root possesses aphrodisiac, demulcent, general tonic, diuretic, anti-inflammatory, antiseptic, anti-oxidant and antispasmodic properties. Regular use of asparagus root treats infertility, impotence, leucorrhea, menopause syndromes, hyperacidity, and certain infectious diseases such as herpes and syphilis.

It is also useful in treatment of epilepsy, kidney disorders, chronic fevers, excessive heat, stomach ulcers and liver cancer, increases milk secretion in nursing mothers and regulates sexual behaviors.

Asparagus racemosus cleanses, nourishes, and strengthens the female reproductive organs and so, it is traditionally used for postmenopausal syndrome (PMS), amenorrhea, dysmenorrhea, menopause and pelvic inflammatory disease (PID) like endometriosis. *Asparagus racemosus* is considered as the most potent female health tonic.

Asparagus racemosus also supports deeper tissue and builds blood, helping in treating infertility, prevents miscarriage and acts as a post-partum tonic as it increases lactation, regularizes the uterus and balances hormones, probably due to phytoestrogens. *Asparagus*

racemosus is also suggested for its soothing agent upon systemic dryness which is part of the natural aging process. It endorses positive emotions that calming fresh sensitivity and the sizzling emotions such as irritability, anger, jealousy, resentment, and hatred. It also helps with pain, restless sleep, disturbing dreams, and those who have weak emotional and physical heart.

Asparagus racemosus possesses a strong rejuvenating, fostering, and stabilizing action on excessive air, gas, dryness and agitation in the body and mind; for this action, the root infusion is traditionally used in treating nervousness, anorexia, insomnia, hyperactive children, and slow growing of humans.

According to Ayurvedic Indian Herbal system*; Asparagus racemosus* is conceivably the best known as a female rejuvenanitive, used for stimulation of milk production in lactating women, useful for childlessness, decreased libido, threatened miscarriage, menopause, leucorrhea and has the capability to balance pH in the cervical area, and as a good remedy for impotence and general sexual weakness.

Asparagus racemosus is prescribed for stomach ulcers, hyperacidity and diarrhea, dry and irritated membranes of the vagina and in the upper respiratory tract. It is beneficial in treating bronchitis as well.

Chemical constituents: Shatavari roots contain 4 steroids saponin; Sahtavarin I –IV (0.2%). Shatavarin-I is the major glycoside with three glucose & a rhamnose moieties attached to saraspogenin, whereas in sahatvarin –IV two glucose & one rhamnose moiet ies attached.

Chemical constituents: Shatavari is known to possess a wide range of phytochemical constituent which are mentioned below.

1. Steroidal saponins, known as shatvarins. Shatvarin I to VI are present. Shatvarin I is the major glycoside with 3-glucose and rhamnose moieties attached to sarsapogenin.[20, 21, 22, 23] Recently, Shatavarin V, Asparinins, Asparosides, Curillins, Curillosides have also been reported.[23]
2. Oligospirostanoside referred to as Immunoside.[24]
3. Polycyclic alkaloid- Aspargamine A, a cage type pyrrolizidine alkaloid.[25, 26, 27]
4. Isoflavones - 8-methoxy- 5, 6, 4-trihydroxy isoflavone-7-0-beta-D-glucopyranoside.[28]
5. A cyclic hydrocarbon-Racemosol i.e. dihydrophenantherene.[29, 30]

6. Furan compound- Racemofuran.[31]

7. Carbohydrates- Polysacharides, mucilage.[32]

8. Flavanoids- Glycosides of quercitin, rutin and hyperoside are present in flower and fruits.[33]

9. Sterols- Roots also contain sitosterol, 4,6-dihydryxy-2-O(-2-hydroxy isobutyl) benzaldehyde and undecanyl cetanoate.[34]

10. Trace minerals - are found in roots-zinc (53.15), manganese (19.98), copper (5.29), cobalt (22.00 microgram per gram) along with calcium, magnesium, potassium zinc and selenium.[35, 36]

11. Kaepfrol- Kaepfrol along with Sarsapogenin from woody portions of tuberous roots could be isolated. [37]

12. Miscellaneous- Essential fatty acids- Gamma Linoleinic acids, Vitamin A, Diosgenin, quercetin 3-glucourbnides.[38, 39, 40]

ACTIONS OF *ASPARAGUS RACEMOSUS*

IN FEMALES

Effect in young females: In young females it may increase weight of ovaries and may enhance folliculogenesis, as evidenced by a histological study of ovaries of immature female *rats*. A significant rise is serum follicle stimulating hormones (FSH) is observed with a dose 100 mg/kg of *Asparagus racemosus* root extract. [41] In a study the mammogenic effect of topical application of phytoestrogen containing plant materials was assessed in female *wistar rats*. A significant increases in size of the breast and teats has been reported, further histological study of breast tissues showed hyperplasia which was not like the changes typical of late pregnancy and lactation. The effect is being hypothesized due to the phytoestrogens,[42] but the mechanism of action is not justified.

Problems related with menstruation: The constituents of *Asparagus racemosus* make it useful in menstrual disorders such as dysmenorrhea, premenstrual syndrome, irregular bleeding during perimenopausal period and also in situations after menopause. *Asparagus racemosus* contain saponins which hinder the oxytocic activity on uterine musculature, thereby maintain the spontaneous uterine motility, confirming its utility in dysmenorrhea which comprises of painful menstruation without significant pelvic pathology.[43]

A medicinal composition containing *Asparagus racemosus* has been made and patented for the treatment of PMS in human females.[44]

Problems related with female infertility

It has been demonstrated that the *Asparagus racemosus* containing preparations stimulate haemopoetic function and increase weight of accessory sex glands.[45, 46] The plant is also beneficial in female infertility, [47] as it enhances folliculogenesis and ovulation, prepares the womb for conception, and prevents miscarriages.[48, 49]

Problems related with menopause

A common practice to relieve menopausal symptoms is to administer hormone replacement therapy, [50] which is not free from adverse effects. Therefore women are turning to natural medicine in an attempt to have a safe alternative to synthetic steroidal hormones. *Asparagus racemosus* being known source of phytoestrogens can be effective in reducing adverse menopausal symptoms (The chemicals entities from plants which mimic hormones are called phytoestrogens). These are weaker than natural estrogens in action.[51]

The symptoms of a menopause are due to the body experiencing a withdrawal to estrogen, during thus phytoestrogens occupy vacant receptors and stimulate estrogenic action.[52] Various formulas containing *Asparagus racemosus* have shown their effectiveness in alleviating the symptoms in and postmenopausal period and in hysterectomised patients.[53, 54, 55]

Use in mammary carcinoma

There are several studies that indicate a lower rate of breast cancer in populations with a high exposure to phytoestrogens.[56] However, contradictory studies also exist regarding this evaluation. Studies found no association between phytoestrogens and breast cancer.[57] *Asparagus racemosus* is well known for its phytoestrogenic properties and use as a hormone modulator demonstrated the inhibitory action of *Asparagus racemosus* on DMBA-induced mammary carcinogenesis in *rats*.[58] The root powder obtained after extraction with chloroform and methanol (1:1) was added in different percentages to the animal feed. *Rats* fed on a 2% *Asparagus racemosus* diet showed a significant ($p < 0.05$) decline in both tumour incidence and mean number of tumours per tumour bearing animal. They concluded that *Asparagus racemosus* root extract exerted a mammotropic and/or lactogenic influence on

normal as well as on oestrogen primed animals thereby rendering the mammary epithelium refractory to the carcinogen.

Pregnancy

Antiabortifacient

The preparations based on *Asparagus racemosus* roots (eg.Shatavari sidh ghrit) are recommended in cases of threatened abortions.[59] This activity is due to Shatavarin-I.[60] Which blocks even oxytocin induced contractions in rat, guinea pig and rabbit uteri in vivo and in situ in a dose dependent manner. The researchers also confirmed that the in vivo effect of shatvarin IV i.e. Saponin A_4on the uterine muscles is just like the estrogen.[61] The polycyclic alkaloid asparagamine A is also reported to have an antioxytocic action,[62] showing an antiabortifacient affect.

Antenatal tonic

Asparagus racemosus root extract has shown to treat preeclampsia associated with pregnancy. In a clinical trial done on Sujat with 450 patient's reports that regular use of this *Asparagus racemosus* containing capsule during antenatal period enhances the fetal wt. and foetal out come and decreases the incidence of perinatal deaths. The incidence of pregnancy induced hypertension (PIH) is also decreased. Anti ADH activity also helps in maintaining blood pressure and decreasing edema of pregnancy by causing dieresis.[63]

Post partum tonic

Galactogogue

Asparagus racemosus is termed as stanya i.e. galactogogues in ayurveda. It has been investigated by a number of researchers and they found that its roots, and root extracts can improve lactational inadequacy in lactating mothers.[64, 65] Lactogenic effects of these were investigated in *guinea pigs*,[66] *goats* ,[67] *buffaloes*[68, 69] and humans.[70] After administration of alcoholic extract of *Asparagus racemosus* a significant increase in milk yield has been observed along with increased growth of the mammary glands, alveolar tissues and acini.[71]

The intramuscular administration of alcoholic extract of shatavari root produced an increase in weight of mammary glands in post partum-estrogen primed *rats* and increased uterine weight in estrogen primed group. These were an increase in weights of adrenals coupled with depletion of ascorbic acid, suggesting the release of pituitary Adrenocorticoid hormone

(ACTH). [71] The growth of lobuloalvelar tissue and milk secretion in the estrogen primed *rats* was thought to be due to the action of released corticoids or prolactin.[66]

ASPARAGUS RACEMOSUS AS ANTIOXIDANT

Antioxidants are intimately involved in the prevention of cellular damage – the common pathway for cancer, aging, and a variety of diseases. *Asparagus racemosus* possess antioxidant properties. Methanolic extract (100mg/kg BW p. o.) given to orally for 15 days and it increase the antioxidant defense, that is, enzymes superoxidase dimutase, catalase and ascorbic acid, increase significantly whereas a significantly decrease in lipid peroxidation.[72] The anti oxidant properties was found due to presence of Isoflavons specially racemofuran, asparagamine A and racemosol.[73]

IN MALES

Shatavari has also been studied for its influence on the male reproductive system. [74] They found that *rats* fed with *Asparagus racemosus* root powder (0.5 g/kg rat feed) for 21 consecutive days exhibited significantly high testes weights as compared to untreated controls. This however, is an isolated report and can be investigated further to broaden our understanding regarding the effect of Shatavari on the male reproductive system as well.

AS ANTIBACTERIAL

Different concentrations (50, 100, 150 microg/ml) of the methanol extract of the roots of *Asparagus racemosus* Wild. showed considerable in vitro antibacterial efficacy against *Escherichia coli, Shigella dysenteriae, Shigella sonnei, Shigella flexneri, Vibrio cholerae, Salmonella typhi, Salmonella typhimurium, Pseudomonas putida, Bacillus subtillis* and *Staphylococcus aureus*. [11]

In another study of root extract of *Asparagus racemosus* showed the spectrum of inhibition on *Staphylococcus aureus, Bacillus subtillis, Staphylococcus werneri, Pseudomonas putida, Pseudomonas aeruginosa* and *Proteus mirabilis* by cylinder plate method. The observations revealed significant zone of inhibition and supports to antibacterial activity. [75]

AS CYTOTOXICITY, ANTI-DIARRHOEAL AND ANALGESIC

A study was designed to evaluate the Cytotoxicity, Anti-diarrhoeal and Analgesic properties of the ethanol extract of whole plant *Asparagus racemosus.*[76]

In another study evaluate the effect of aqueous and ethanol extract of *Asparagus racemosus* for its antidiarrhoeal potential against several experimental models of diarrhoea in *Albino wistar rats*.[77]

AS ANTISECRETORY AND ANTIULCER ACTIVITY

Asparagus racemosus was found to be an effective antiulcerogenic agent, whose activity can well be compared with that of ranitidine hydrochloride in *rats*. The result of study suggests that *Asparagus racemosus* causes an inhibitory effect on release of gastric hydrochloric acid and protects gastric mucosal damage.[78]

AS ANTIDEPRESSANT

A study was undertaken to investigate the effect of *Asparagus racemosus* wild on depression in *mice* using tail suspension test and forced swim test. Methanolic extract of *Asparagus racemosus* showed significant antidepressant-like activity probably by inhibiting MAO-A and MAO-B; and through interaction with adrenergic, dopaminergic, serotonergic and GABAergic systems.[79]

CONCLUSION

Shatavari or Satmuli is a very important medicinal plant, which is used, in many (allopathically) incurable diseases in Ayurveda and also in Himalayan traditional medicine system. Traditionally this plant is used as a reproductive tonic. It is also used as Antidepressant, Anti-diarrhoeal, Antiulcerogenic action, antibacterial, analgesic, Antioxidant, cytotoxic etc. The plant shows the presence of many chemical constituents which are responsible for various pharmacological and medicinal properties. The evaluation needs to be carried out on *Asparagus racemosus* in order to uses and formulation of the plant in their practical clinical applications.

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